The State of the PDS4 Information Model

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Planetary Data Archives
Support Services, and Tools I
Wednesday, June,19 2019
8:45 a.m. HCCC Humphreys

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Foundational Principles[1,2,3]

- The IM defines a knowledge base for the Planetary Science community.
- The IM remains independent of the implementation
- Repository obtains the following categories of information
  - **Identification** – allows information object to be discovered and accessed.
  - **Representation/Format** - allows a data object to be interpreted.
  - **Fixity** - ensures the information object has not been unintentionally altered.
  - **Provenance** – essential for authenticity
  - **Context** - describes the environment in which the data object was created.
  - **Reference** - allows the information objects to be referenced

[1] Open Archival Information System (OAIS) Reference Model (ISO 14721)
[2] Metadata Registry Specification (ISO/IEC 11179)
[3] W3C XML (Extensible Markup Language) specifications

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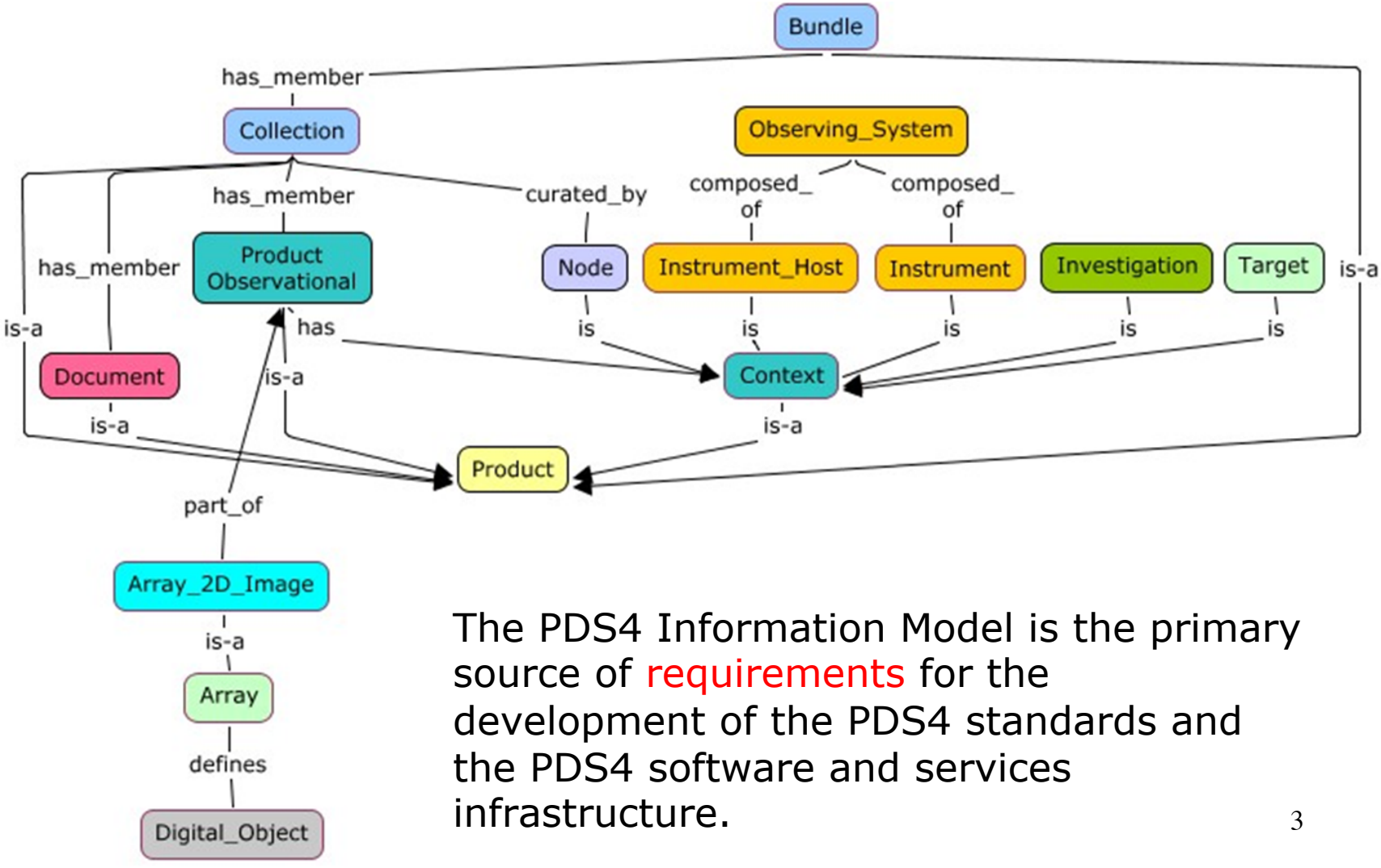
General Concept Map



The PDS4 Information Model is the primary source of requirements for the development of the PDS4 standards and the PDS4 software and services infrastructure.

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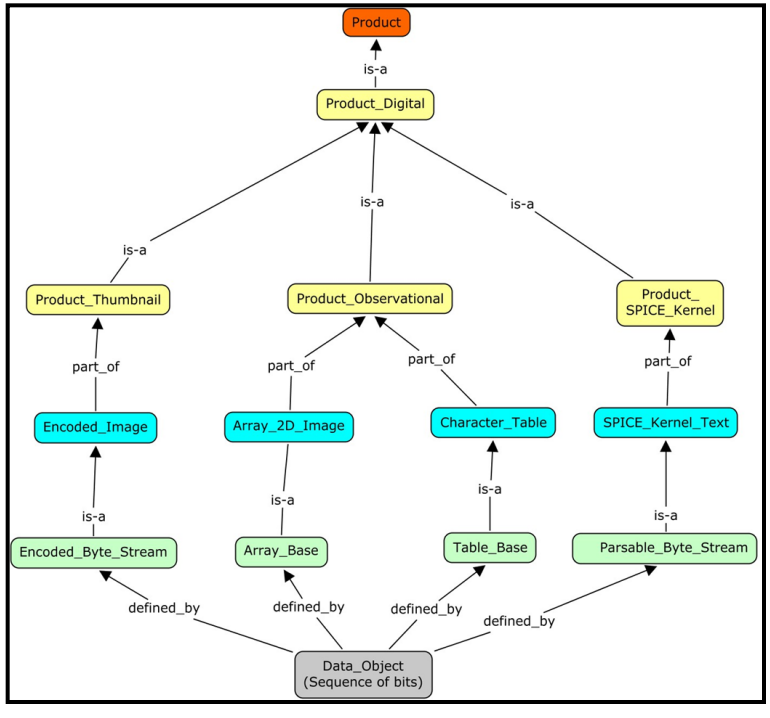
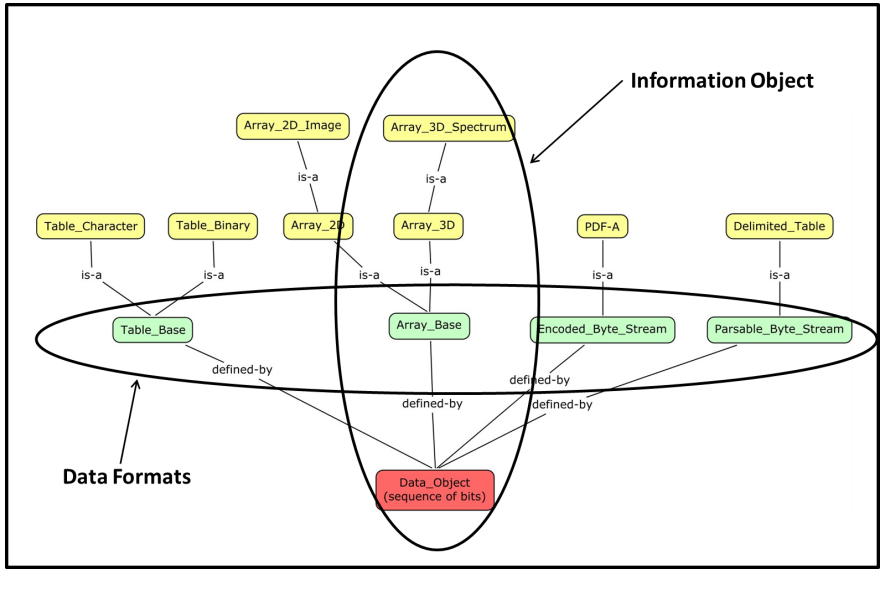
Product Concept Map

- Defines and provides templates for capturing
  - data structure (format)
  - context within which the data was captured, processed, and archived
  - the relationships between the data





- The single authoritative source for:
  - *The System's Data Standards.*
  - *The System's Data Requirements*
    - registration, search, retrieval, process, analysis, and long-term preservation

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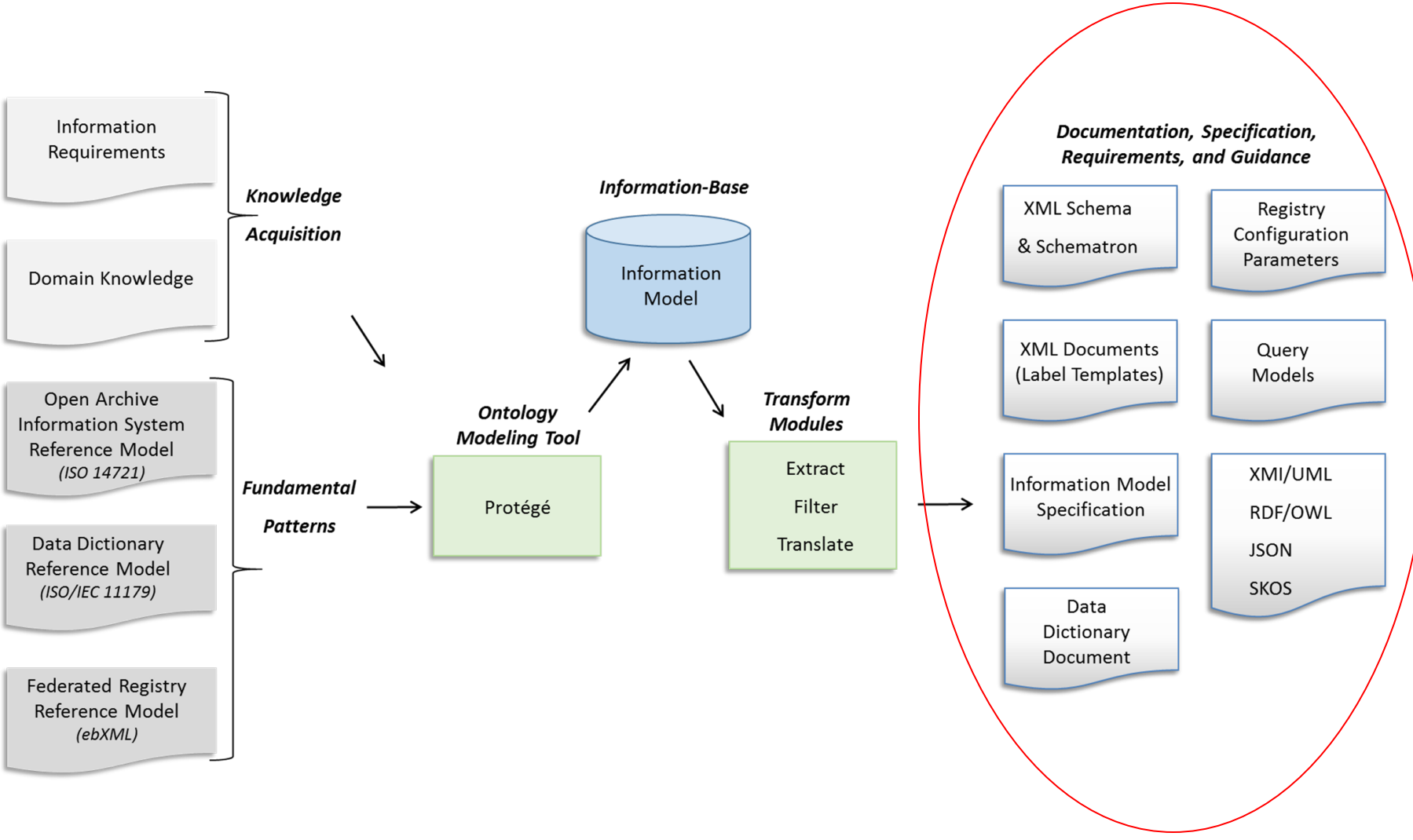
Configuring Software and Services



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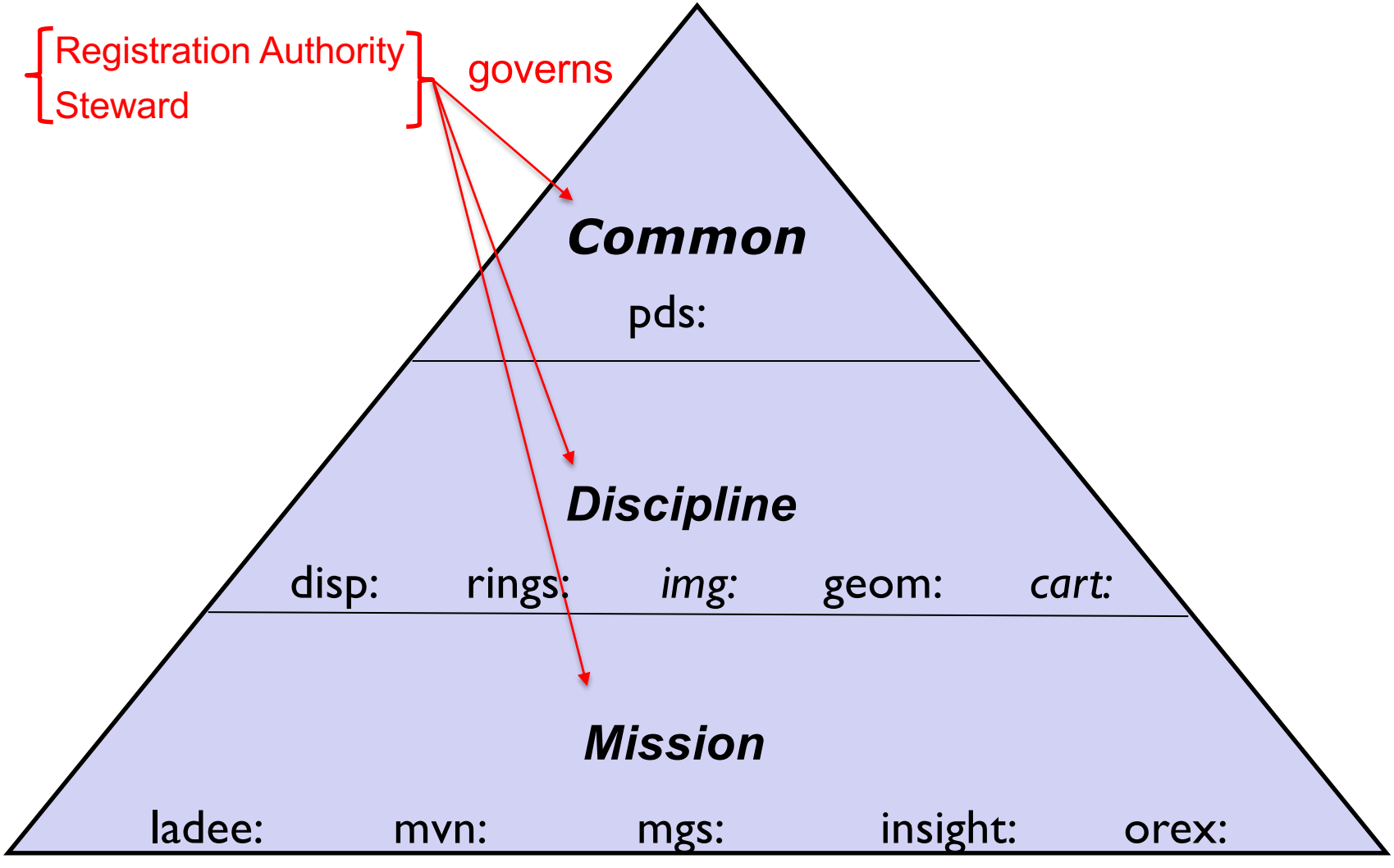
Multi-level Governance



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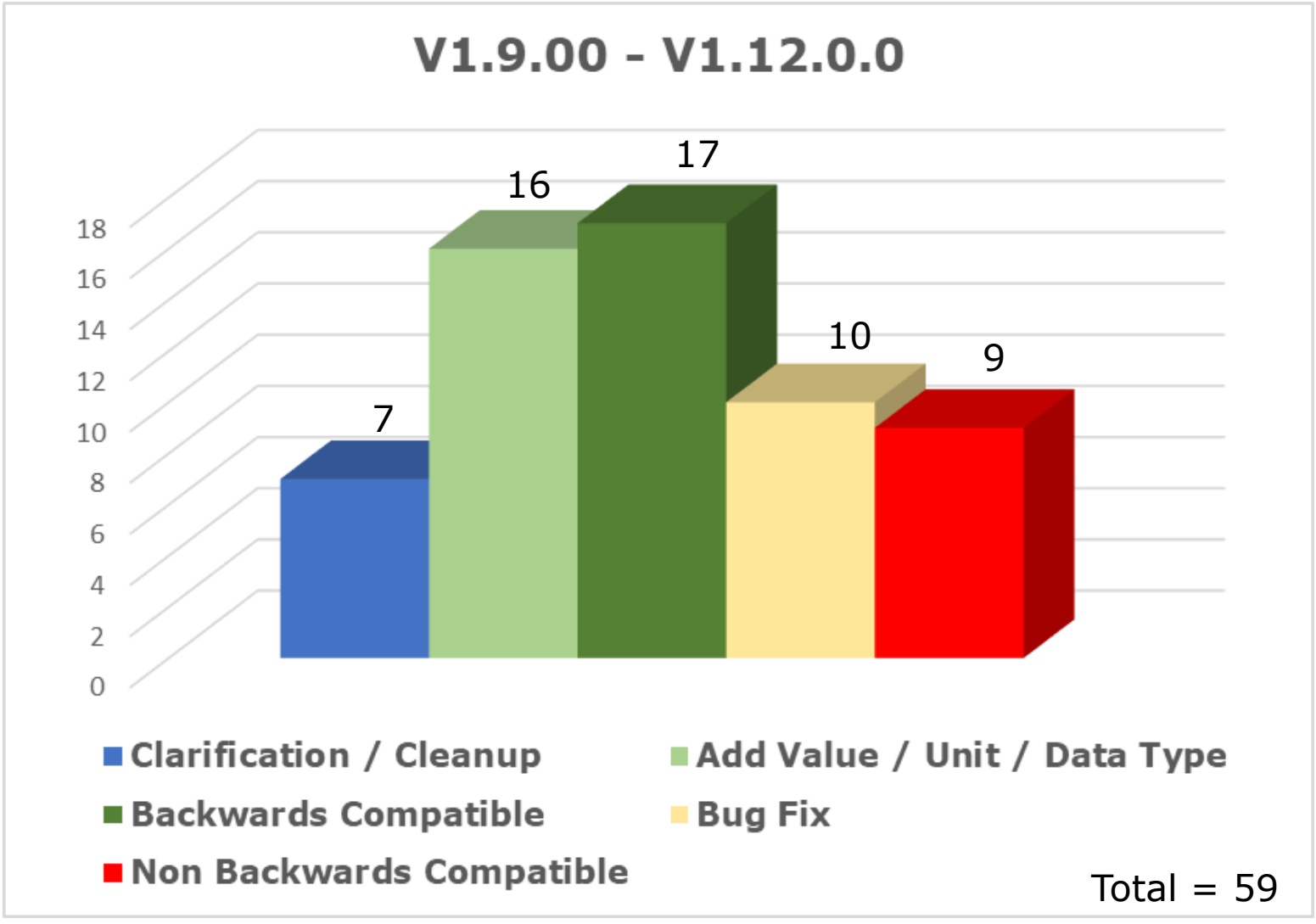
Controlled Extensions

Common		
	PDS4_PDS_1B10	PDS4 Common
Discipline		
	PDS4_ALT_1000	PPI Node's Alternate
	PDS4_CART_1B10_1930	Imaging Node's Cartography
	PDS4_DISP_1B10	Imaging Node's Display
	PDS4_GEOM_1B10_1700	Geometry
	PDS4_IMG_1B00_1600	Imaging Node
	PDS4_IMG_SURFACE_1B10_1100	Surface Imaging
	PDS4_MSN_SURFACE_1B00_1100	Surface Mission Information
	PDS4_MSN_1B00_1100	Generic Mission
	PDS4_MULTI_1900_1000	multidimensional data
	PDS4_PARTICLE_1900_1100	PPI Node's Particle
	PDS4_PROC_1900	Processing History
	PDS4_RINGS_1800_1500	Rings Node
	PDS4_SP_1C00_1100	Spectral
	PDS4_SPECLIB_1000	Spectral Library
	PDS4_WAVE_1000	PPI Node's Wave
Mission		
	BOPPS_1100	BOPPS
	PDS4_CASSINI_1B00_1200	Cassini
	PDS4_DAWN_1B00_1000	Dawn
	PDS4_INSIGHT_1B00_1850	Insight
	PDS4_JUNO_1900	JUNO
	LADEE_1100	LADEE
	PDS4_MESS_1B00_1020	Messenger
	MGS_1700	*Mars Global Surveyor*
	MPF_1700	*Mars Pathfinder*
	PDS4_MVN_1021	MAVEN
	OSIRIS-Rex _1700	*OSIRIS-Rex*
	PDS4_VG1_1900_1000	VOYAGER 1 (vg1)
	PDS4_VG2_1900_1000	VOYAGER 2 (vg2)

Metrics
Changes to the Common Dictionary



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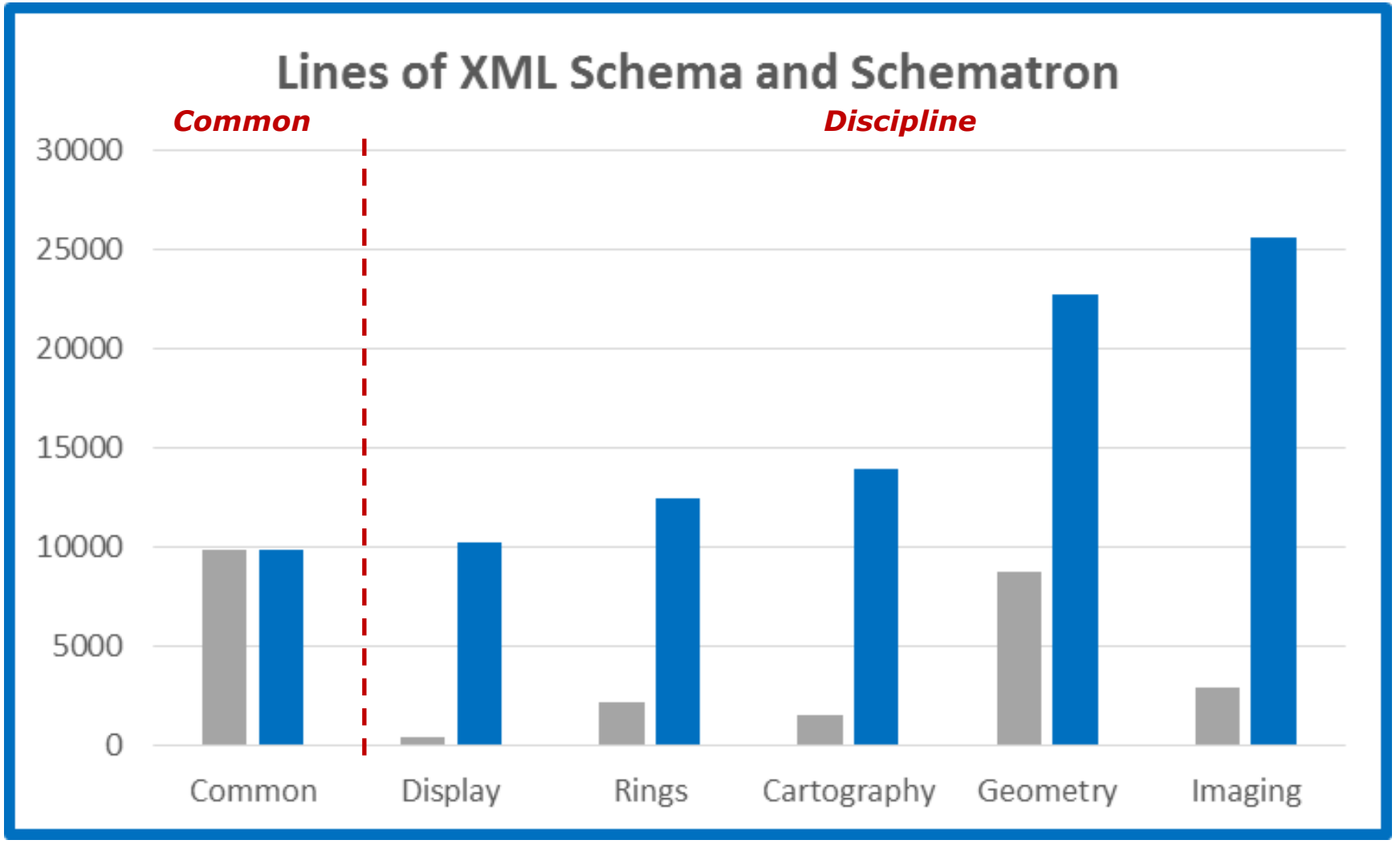
Auto-generated Validation Code



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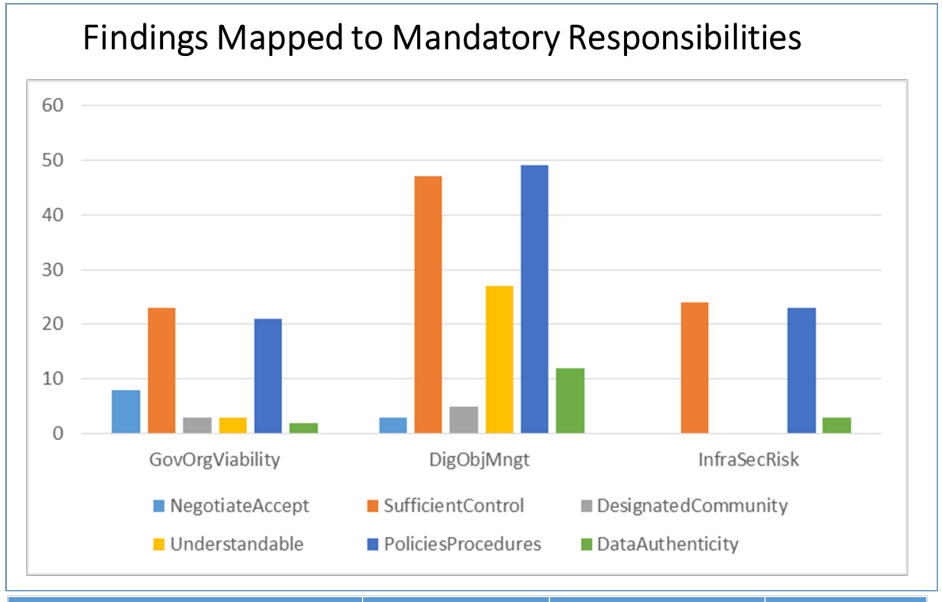
Desk Audit – ISO 16363

- The assessment of PDS4 found that 92% of the metrics of the ISO 16363 standard were satisfied.
  - 80% of the metrics for Governance and Organizational Viability
  - 95% of the metrics for Digital Object Management
  - 96% of the metrics for Infrastructure and Security Risk Management.



ISO 16363 Section	Satisfied Metrics	Unsatisfied Metrics	Total Metrics
Governance and Organizational Viability	20	5	25
Digital Object Management	57	3	60
Infrastructure and Security Risk Management	23	1	24
Total	100	9	109

Semantic Technologies

- Under PDS4 all registry objects are first class products.
  - *All products have a Persistent Identifier (PID)*
  - *Named relationships (semantic) are used to relate products using PDS4 PIDs*
    - data, documents, people, software, and contextual objects
  - *Supports Linked Open Data*

- *Evolutionary development*
  - *Adding value by leveraging semantic content*

Conclusions

- The PDS4 Information Model-Driven architecture is meeting the requirements for a "trusted" digital repository for long-term preservation.
  - Maintains the usefulness, reusability, and interoperability of the data.
  - Stays relevant through involvement of domain experts
  - Follows "agile" develop cycle with periodic delivery and testing
- Unleashing the full power of PDS4
  - See "Multimission Labels in PDS", Deen, B., et. al.

Conclusions

- The PDS4 Information Model will scale to meet the increased diversification in science data types and science data processing and analytics
  - Expanding the community through the IPDA.
  - Extensions for:
    - dynamic metadata (updates and transients)
    - targeted relevant searches
    - data analytics
    - semantic reasoning
    - reproducibility

Thank You

Backup

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Why be certified?

- To provide proof that the repository is doing a good job
- Help users make a choice between competitive repositories
- Instils confidence in depositors – so they are more likely to deposit
- Instils confidence in consumers – so they are likely to increase their usage and have greater trust in the information provided
- Instils confidence from upper management
- Instils confidence from funders – i.e. that they are not wasting their money
- Certification under ISO 16363 demonstrates and reinforces the repository's commitment to its mission.

PDS4 Overview

- PDS4 is an information model-driven system architecture
  - *Supports the capture, management, distribution and integration of planetary science data captured in distributed data archives world-wide.*

- The PDS4 Information Model (IM) is the core element of the architecture
  - *Developed using lessons learned from 20 years of archiving Planetary Science Data*
  - *Used accepted standards for information model development*
    - Open Archival Information System (OAIS) Reference Model (ISO 14721)
    - Metadata Registry Specification (ISO/IEC 11179)
    - W3C XML (Extensible Markup Language) specifications.